(Part-I)

Q.2. Write short answers to any Five (5) questions: (10)

(i) Write down the empirical formula of glucose and silica.

Ans The empirical formula of glucose is CH_2O and that of silica is SiO_2.

(ii) Define mole and give example.

Ans The atomic mass of an element expressed in grams is called gram atomic mass or gram atom. It is also called a mole.

1 gram atom of hydrogen = 1.008 g =

1 mol of hydrogen atoms

(iii) Define element. Write the name of element that occurs in liquid state.

Ans "It is a substance made up of same type of atoms, having same atomic number and cannot be decomposed into simple substances by ordinary chemical means."

It means that each element is made up of unique type of atoms that have very specific properties.

There are very few elements which occur in liquid state e.g., mercury and bromine.

(iv) How nucleus was discovered by Rutherford?

Ans Rutherford performed 'Gold Foil' experiment to understand how negative and positive charges could

coexist in an atom. He bombarded alpha particles on a 0.00004 cm thick gold foil.

He observed the effects of α-particles on a photographic plate or a screen coated with zinc sulphide.

The deflection of a few particles proved that there is a 'center of positive charges' in an atom, which is called 'nucleus' of an atom.

(v)   Define electronic configuration.

Ans The distribution of electrons around the nucleus in various shells and subshells according to their increasing energy, is called electronic configuration.

(vi)   State modern periodic law. Who put forward this law?

Ans In 1913, H. Moseley discovered a new property of the elements i.e., atomic number. He observed that atomic number instead of atomic mass should determine the position of element in the periodic table and accordingly the periodic law was amended as "properties of the elements are periodic function of their atomic numbers".

(vii)   Write the trend of shielding effect in the periodic table.

Ans With increase of atomic number, the number of electrons in an atom also increases, that results in increase of shielding effect.

The shielding effect increases down the group in the periodic table. Because of this, it is easy to take away electron from Potassium (Z = 19) than from Sodium (Z = 11) atoms. Similarly, the shielding effect remains the same in a period if we move from left to right.

(viii) Why elements of group 1st and 2nd are called 's' block elements?

Ans Elements of group 1 and 2 have valence electrons in 's' subshell. Therefore, they are called s-block elements.

Q.3. Write short answers to any FIVE (5) questions: (10)

(i) Write down the name of four types of chemical bonds.

Ans Depending upon the way how valence electrons are involved in bonding, they result in following four types of chemical bonds:

1. Ionic Bond
2. Covalent Bond
3. Dative Covalent or Coordinate Covalent Bond
4. Metallic Bond

(ii) Differentiate between donor and accepter in coordinate covalent bond.

Ans

Donor	Acceptor
The atom which provides the electron pair is termed as donor atom.	The other atom which accepts the electron pair is termed as acceptor.

(iii) How is polar covalent bond formed?

Ans When two atoms approach each other, attractive forces develop between electrons of one atom and nucleus of other atom. Simultaneously, repulsive forces between electrons of the two atoms as well as between their nuclei are also created. When the attractive forces dominate due to decrease in distance between those two atoms, a chemical bond is formed between them.

(iv) How does intermolecular forces affect the evaporation of a liquid?

Ans If intermolecular forces are stronger, molecules face difficulty in evaporation. For example, water has stronger intermolecular forces than alcohol, therefore, alcohol evaporates faster than water.

(v) How does temperature affect vapour pressure of a liquid?

Ans At high temperature, vapour pressure is higher than at low temperature. At elevated temperature, the kinetic energy of the molecules increases enough to enable them to vaporize and exert pressure.

(vi) What is difference between saturated and unsaturated solution?

Ans

Saturated solution	Unsaturated solution
A solution containing maximum amount of solute at a given temperature is called saturated solution.	A solution containing lesser amount of solute than that which is required to saturate it at a given temperature, is called unsaturated solution.

(vii) What is meant by volume/mass % (v/m%)?

Ans It is the volume in cm^3 of a solute dissolved in 100 g of the solution. For example, 10 % v/m alcohol solution in water means 10 cm^3 of alcohol is dissolved in (unknown) volume of water so that the total mass of the solution is 100 g.

(viii) How can you distinguish between solution and a pure liquid?

Ans The simplest way to distinguish between a solution and a pure liquid is evaporation. The liquid which evaporates completely, leaving no residue, is a pure

solvent, while a liquid which leaves behind a residue on evaporation is solution.

Q.4. Write short answers to any FIVE (5) questions: (10)

(i) **What do you mean by oxidizing agent? Give an example.**

Ans. An oxidizing agent is the specie that oxidise a substance by taking electrons from it. The substance (atom or ion) which is reduced itself by gaining electrons is also called oxidizing agent. Non-metals are oxidizing agents because they accept electrons being more electronegative elements.

(ii) **What do you mean by rust? Write its equation.**

Ans. The Fe^{2+} formed spreads throughout the surrounding water and reacts with O_2 to form the salt $Fe_2O_3.nH_2O$ which is called **rust**. It is also a redox reaction.

$$2Fe^{2+}_{(aq)} + \frac{1}{2}O_{2(g)} + (2+n)H_2O_{(l)} \longrightarrow Fe_2O_3 . nH_2O_{(s)} + 4H^+_{(aq)}$$
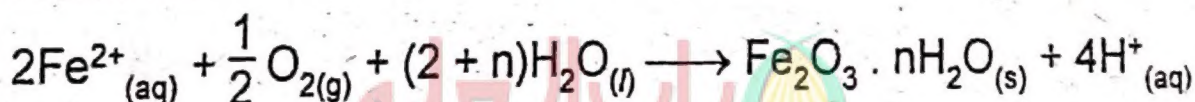
(iii) **Define oxidation number.**

Ans. Oxidation state or oxidation number (O.N.) is the apparent charge assigned to an atom of an element in a molecule or in an ion. For example: in HC1, oxidation number of H is $+1$ and that of Cl is -1.

(iv) **What do you mean by redox reaction? Give an example.**

Ans. Chemical reactions in which the oxidation state of one or more substances changes are called oxidation-reduction or redox reactions.

Example:

$$Zn + 2HCl \longrightarrow ZnCl_2 + H_2$$
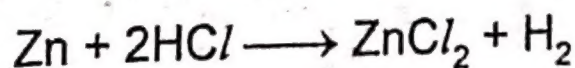
(v) **Name four moderately reactive metals.**

Ans. Following are the four moderately reactive metals are:

1. Zinc	2. Iron
3. Tin	4. Lead.

(vi) Give the trend of electropositivity in a group and a period.

Ans Electropositive character increases down the group because size of atoms increases. For example, lithium metal is less electropositive than sodium which is in turn less electropositive than potassium.

Electropositive character decreases across the period from left to right in the periodic table because atomic sizes decrease due to increase of nuclear charge.

(vii) Write any two uses of platinum.

Ans Platinum is used to make jewelry items because of its unique characteristics like colour, beauty, strength, flexibility and resistance to tarnish. It provides a secure setting for diamonds and other gemstones, enhancing their brilliance.

(viii) What do you mean by non-metals?

Ans Non-metals form negative ions (anions) by gaining electrons. In this way, non-metals are electronegative in nature and form acidic oxides.

(Part-II)

NOTE: Attempt any TWO (2) questions.

Q.5.(a) Write down any five differences between Rutherford's atomic theory and Bohr's atomic theory. (5)

Ans For Answer see Paper 2016 (Group-II), Q.5.(b).

(b) Explain compound and give its classification. (4)

Ans Compound:

Compound is a substance made up of two or more elements chemically combined together in a fixed ratio by mass. As a result of this combination, elements lose their own properties and produce new substances (compounds) that have entirely different properties. Compounds can't be broken down into its constituent elements by simple physical methods. For example, carbon dioxide is formed when elements of carbon and oxygen combine chemically in a fixed ratio of 12:32 or 3:8 by mass. Similarly, water is a compound formed by a chemical combination between hydrogen and oxygen in a fixed ratio of 1:8 by mass.

Compounds can be classified as ionic or covalent. Ionic compounds do not exist in independent molecular form. They form a three-dimensional crystal lattice, in which each ion is surrounded by oppositely charged ions. These oppositely charged ions attract each other very strongly, as a result ionic compounds have high melting and boiling points. These compounds are represented by formula units e.g., $NaCl$, KBr, $CuSO_4$.

The covalent compounds mostly exist in molecular form. A molecule is a true representative of the covalent compound and its formula is called molecular formula e.g., H_2O, HCl, H_2SO_4, CH_4.

Q.6.(a) Define dipole-dipole interaction and explain it with an example. (5)
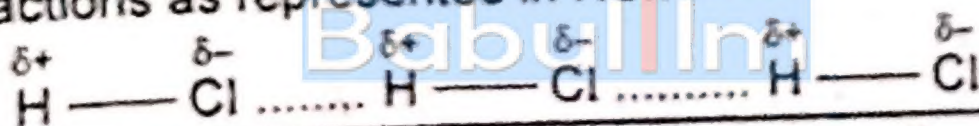
Ans. Dipole-Dipole Interaction:

All intermolecular forces, which are collectively called van der Waals forces, are electrical in nature. They result from the attractions of opposite charges which may be

temporary or permanent. The unequal sharing of electrons between two different types of atoms make one end of molecule slightly positive and other end slightly negatively charged. As shared pair of electrons is drawn towards more electronegative atom, it is partially negatively charged, as chlorine in hydrogen chloride. The other end automatically becomes partially positively charged.

$$\overset{\delta+}{H} \text{———} \overset{\delta-}{Cl}$$

When partial positive and partial negative charges exist at different positions in a molecule, the adjacent molecules will arrange themselves in such a way that negative end of that molecule comes near to positive end of other molecule. It results in a net forces of attraction between oppositely charged ends of two adjacent molecules. These attractive forces are called dipole-dipole interactions as represented in HCl:

$$\overset{\delta+}{H} \text{———} \overset{\delta-}{Cl} \text{........} \overset{\delta+}{H} \text{———} \overset{\delta-}{Cl} \text{..........} \overset{\delta+}{H} \text{———} \overset{\delta-}{Cl}$$

(b) Explain that evaporation is a continuous and cooling process. (4)

Ans Evaporation:

The process of changing of a liquid into a gas phase is called evaporation. It is reverse to condensation in which a gas changes into liquid. Evaporation is an endothermic process (heat is absorbed). Such as when one mole of water in liquid state is converted into vapour form, it requires 40.7 kJ of energy.
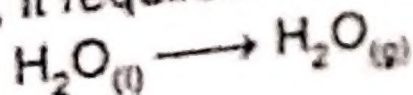
$$H_2O_{(l)} \longrightarrow H_2O_{(g)} \qquad \Delta H^\circ_{vap} = 40.7 \text{ kJ mol}^{-1}$$

In the liquid state, molecules are in a continuous state of motion. They possess kinetic energy but all the molecules do not have same kinetic energy. Majority of the molecules have average kinetic energy and a few have more than average kinetic energy. The molecules having more than average kinetic energy overcome the attractive forces among the molecules and escape from the surface. It is called as evaporation.

Evaporation is a continuous process taking place at all temperatures. The rate of evaporation is directly proportional to temperature. It increases with the increase in temperature because of increase in kinetic energy of the molecules.

Evaporation is a cooling process. When the high kinetic energy molecules vapourize, the temperature of remaining molecules falls down. To compensate this deficiency of energy, the molecules of liquid absorb energy from the surroundings. As a result, the temperature of surroundings decreases and we feel cooling. For example, when we put a drop of alcohol on palm, the alcohol evaporates and we feel cooling effect.

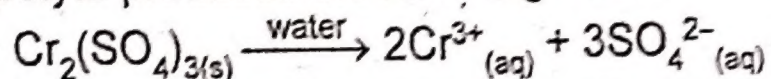**Q.7.(a) Define electroplating and explain the electroplating of chromium.** (5)

Ans Electroplating is depositing of one metal over the other by means of electrolysis. This process is used to protect metals against corrosion and to improve their appearance.
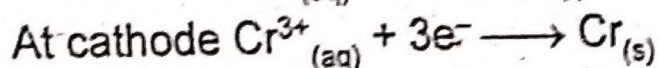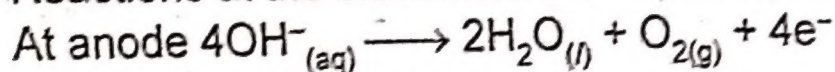
Electroplating of Chromium:

The electroplating of chromium is carried out in the same way as that of silver. The object to be electroplated is dipped in aqueous solution of chromium sulphate containing a little sulphuric acid, that acts as an electrolyte. The object to be electroplated acts as cathode while anode is made of antimonial lead. The electrolyte ionizes and provides Cr^{3+} ions, which reduce and deposit at cathode.

Electrolyte produces the following ions:

$$Cr_2(SO_4)_{3(s)} \xrightarrow{\text{water}} 2Cr^{3+}_{(aq)} + 3SO_4^{2-}_{(aq)}$$

Reactions at the electrodes are as follows:

At anode $4OH^-_{(aq)} \longrightarrow 2H_2O_{(l)} + O_{2(g)} + 4e^-$

At cathode $Cr^{3+}_{(aq)} + 3e^- \longrightarrow Cr_{(s)}$

For practical convenience, the steel is usually plated first with nickel or copper and then by chromium because it does not adhere well on the steel surface. Moreover, it allows moisture to pass through it and metal is stripped off. The nickel or copper provides adhesion and then chromium deposited over the adhesive layer of copper lasts longer. This type of electroplating resists corrosion and gives a bright silvery appearance to the object.

(b) How much NaOH is required to prepare its 500 cm³ of 0.4 M solution. (4)

Ans Molar mass of NaOH = 40 gmol^{-1}

$$\text{Volume in dm}^3 = \frac{500 \text{ cm}^3}{1000 \text{ cm}^3} \times 1 \text{ dm}^3$$

$$= 0.5 \text{ dm}^3$$

Putting the values in formula:

$$\text{Molarity} = \frac{\text{mass of solute (g)}}{\text{molar mass (g mol}^{-1}) \times \text{volume of the solution (dm}^3)}$$

Mass of solute = Molarity × molar mass × volume

$$= 0.4 \times 40 \times 0.5$$

$$= 8\ g$$